

Goal 1

Understand the Earth system and apply Earth system science to improve prediction of climate, weather, and natural hazards.

Objective 1.2

Expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology.

Why pursue Objective 1.2?

Figure 67: Air quality data from the Environmental Protection Agency, shown as three-dimensional spikes on this map of North America, is expanded and enhanced by data from the Moderate Resolution Imaging Spectroradiometer on the Terra and Aqua satellites, shown as the color overlay. In this image, green indicates healthy air while red indicates the unhealthiest air.

Naturally occurring and human-induced changes in Earth's system have profound consequences for the Nation and the world. NASA's Earth observing capabilities and scientific research, coupled with those from its partners, are helping society manage risks and take advantage of opportunities resulting from Earth system changes.

Through improved predictions of weather, climate, and natural hazards, NASA Earth science research helps the United States and the world make sound, scientifically based decisions in areas such as agriculture, homeland security, ecology, water management, public health, and aviation safety.

By working with Federal agency partners, NASA improves essential public services like tracking hurricanes, assessing crop health and productivity, evaluating forest fire risks, ensuring aviation safety, improving energy forecasts, and determining the potential for the climate-driven spread of infectious disease. NASA's Earth-observing systems and Earth science models advance researchers' ability to understand and protect Earth, its resources, and its diverse and precious life.

NASA's Progress and Achievements in FY 2004

Outcome 1.2.1: By 2012, benchmark the assimilation of observations (geophysical parameters, climate data records) provided from 20 of the 80 remote sensing systems deployed on the flotilla of 18-22 NASA Earth observation research satellites.

This year, NASA and the Environmental Protection Agency's Office of Air Quality Planning and Standards partnered to create a prototype Web-based pollution forecast tool to improve the Environmental Protection Agency's air quality index forecasts. The tool uses data from NASA's Moderate Resolution Imaging Spectroradiometer aboard the Terra and Aqua satellites to forecast air quality and pollution. The Environmental Protection Agency recently integrated the tool into its AIRNow Forecaster Training Workshops, which reach over 200 air quality forecasting professionals.

Using radar altimetry data from NASA's TOPEX/Poseidon and Jason-1 satellites, researchers from NASA, the U.S. Department of Agriculture's Foreign Agricultural Service, and the University of Maryland estimated reservoir height and water volume in approximately 100 lakes and reservoirs around the world's major agricultural regions to locate regional droughts and improve crop

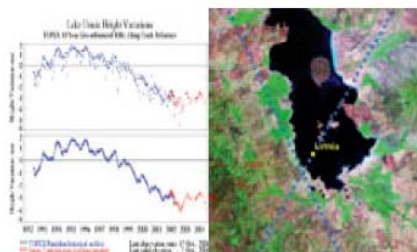


Figure 68: The chart at left shows the relative lake height variations for Lake Urmia, Iran, computed from TOPEX/POSEIDON and Jason-1 altimetry data. It shows that water height has declined steadily since the mid-1990s. The map on the right, taken by Landsat-5, shows the path (marked with blue dots) taken by the Jason-1 spacecraft. Information on this and other lakes and reservoirs around the world are available on the U.S. Department of Agriculture Foreign Agricultural Service's Crop Explorer Web site, at www.pecad.fas.usda.gov/cropeexplorer/global_reservoir/.

production estimates for irrigated regions located downstream. The Foreign Agriculture Service also uses NASA-produced water availability information to make decisions about global agricultural estimates. In a related study, students in NASA's Digital Earth Virtual Environment and Learning Outreach Project program applied NASA research results in testing several new water and energy decision-support tools.

Outcome 1.2.2: By 2012, benchmark the assimilation of 5 specific types of predictions resulting from Earth Science Model Framework (ESMF) of 22 NASA Earth system science models.

Supported by Federal, private sector, and academic partnerships, NASA continues to make strides toward this outcome. This year, NASA catalogued the Earth System Model Data Framework climate and weather prediction models that use data and observations from NASA research satellites. The Agency also evaluated data from its Atmospheric Infrared Sounder temperature and moisture profiles for use in disaster management and aviation applications, including National Oceanic and Atmospheric Administration's Statistical Hurricane Prediction Scheme model. In addition, with the help of the U.S. Geological Survey and the U.S. Department of Agriculture, NASA evaluated results from its Carnegie-Ames-Stanford Approach (CASA) model (developed by scientists from NASA's Ames Research Center, the Carnegie Institute, and Stanford University) and CASA-Carbon Query and Evaluation Support Tools (CQUEST) for use in the Invasive Species Forecasting System that provides decision support for ecosystem and carbon management applications. Using vegetation data from NASA's Moderate Resolution Imaging Spectroradiometer aboard the Terra and Aqua satellites, the CASA model predicts photosynthesis rates, the amount of vegetation and living organisms within a unit area, and "litterfall," which is organic matter from the biosphere that moves to litter layer in soil. CQUEST allows Web users to display, manipulate, and save ecosystem model estimates of carbon sinks (a reservoir that absorbs and stores carbon dioxide from the atmosphere) and carbon dioxide fluctuations in agricultural and forest ecosystems for locations anywhere in the United States

Outcome 1.2.3: By 2012, benchmark the assimilation of observations and predictions resulting from NASA Earth Science research in 8-10 decision support systems serving national priorities and the missions of Federal agencies.

NASA partnered with a number of Federal agencies to produce decision support systems using NASA Earth science research. The table below highlights some of the ongoing partnerships and decision support systems currently in development.

Partner Agency	Activity
U.S. Department of Agriculture	Global crop production assessment NASA Carnegie-Ames-Stanford Approach (CASA) model and CASA-Carbon Query and Evaluation Support Tool (CQUEST)
Environmental Protection Agency	AirNow and Air Quality Forecasting decision support tools
Federal Aviation Administration	Advanced Weather Interactive Processing System
U.S. Geological Survey	Invasive Species Forecasting System
Federal Emergency Management Agency	HAZUS-US tool, a National Flood Loss Estimation Model
U.S. Agency for International Development (AID) and Central American Commission for Environment and Development	SERVIR tool, a regional visualization and monitoring system that will assist the seven nations of Central America in developing a Mesoamerican Biological Corridor extending from southern Mexico to the Colombian border.
Department of Homeland Security	International Materials Assessment and Application Centre
Centers for Disease Control	California Environmental Public Health Tracking Network
U.S. Department of the Interior	RiverWare and Agricultural Water Resources Decision Support tools
National Oceanic and Atmospheric Administration	Coral Reef Early Warning System tool

FY 2004 Performance for Objective 1.2

Performance Measures for Objective 1.2		2004 Rating	2003 2002 2001		
Outcome 1.2.1	By 2012, benchmark the assimilation of observations (geophysical parameters, climate data records) provided from 20 of the 80 remote sensing systems deployed on the flotilla of 18-22 NASA Earth observation research satellites.	green	Outcomes originated in FY 2004		
Outcome 1.2.2	By 2012, benchmark the assimilation of 5 specific types of predictions resulting from Earth Science Model Framework (ESMF) of 22 NASA Earth system science models.	green			
Outcome 1.2.3	By 2012, benchmark the assimilation of observations and predictions resulting from NASA Earth Science research in 8-10 decision support systems serving national priorities and the missions of federal agencies.	green			
APG 4ESA1	National applications: Benchmark measurable enhancements to at least 2 national decision support systems using NASA results, including the use of optical depth derived from MODIS data into the Air Quality Index provided by EPA and the use of ocean height derived from Topex and Jason missions into reservoir monitoring tools with USDA. (This APG applies to Outcomes 1.2.1, 1.2.3)	green	3Y24 green	2Y23 green	1Y14 green
APG 4ESA2	Cross Cutting Solutions: Expand DEVELOP (Digital Earth Virtual Environment and Learning Outreach Project) workforce development program to 2-4 additional states and benchmark the use of NASA research results for water and energy decision support tools. (This APG applies to Outcomes 1.2.1, 1.2.2, 1.2.3)	green	none	none	none
APG 4ESA3	Cross Cutting Solutions: Competitively select at least 5 solutions projects for the Research, Education, Applications solutions Network (REASoN) program to serve national applications through projects that support agriculture, public health and water quality decision support tools. (This APG applies to Outcomes 1.2.1, 1.2.2, 1.2.3)	green	none	none	none
APG 4ESA4	Cross Cut Solutions: Verify and validate at least two commercial remote sensing sources/products for Earth science research including DigitalGlobe Quicksat and OrbImage Overview-3 high resolutions optical imagery. (This APG also applies to Outcome 1.2.1)	green	none	none	none